REMARKS

Claims 1-25 are of record in this application. No claims have been amended, added or canceled.

Rejection Under 35 U.S.C. 103

Claims 1-4, 7-20, 22, and 24 have been rejected under 35 U.S.C. 103 as being unpatentable over Larsen *et al.* in view of Mounce (U.S. 3,851,244). The Examiner has indicated that both Larsen *et al.* and Mounce measure the propagation delay of a microwave signal passed through a material, and that Larsen teaches substantially the same process as the invention except for the step of calculating moisture content. The Examiner has therefor taken the position that it would have been obvious to add the step of calculating moisture content of Mounce to the process of Larsen *et al.* Applicant respectfully disagrees.

Larsen *et al.* (hereinafter referred to as Larsen) discloses a process for the "interrogation" of biological samples by microwave time delay spectroscopy. The process utilizes a time-delay spectrum with first and second microwave signals which are passed through a reference channel and a test channel, and then subsequently combined to produce a time delayed spectrum (col. 3, lines 36-52). Larsen does not disclose any specific examples of

how these measurements of the time delayed spectrum are used, and certainly does not disclose measuring moisture content. However, the specification discloses at col. 1, lines 29-33, that the measurement of both the time delay and signal attenuation (*i.e.*, absorption) "can theoretically be used to characterize the type, functional state, and thickness of the tissue through which the wave length travels." Thus, apparently both time delay and signal attenuation are measured for determining the "interrogation" of biological samples.

Mounce discloses a microwave process and apparatus for measuring moisture content by measuring the attenuation (*i.e.*, absorption) of a fixed base-band microwave signal passed through a test material of interest (see, for example, col. 1, lines 11-22, col. 4, lines 5-13 and 20-28, col. 8, lines 44-59, and claim 1). Mounce only discloses measuring signal attenuation. It does not disclose measuring or using the time delay (or propagation delay) of the signal, nor does Mounce disclose varying the frequency of the signal. While Mounce recognizes the potential effect of the time delay of the signals (*e.g.*, col. 4, lines 29-31), at no point does Mounce disclose measuring the time delay. Rather, the system of Mounce is configured to minimize the effects of time delay (col. 8, lines 44-59).

The instant invention is drawn to a microwave system for measuring the moisture content of cotton bales and other materials which is free from interference by multipath standing waves. As disclosed at page 8 and claim 1, the process includes the steps of:

> 1. producing a primary microwave signal with a varying frequency, this signal may be a continuously varying signal or a discrete time varying signal,
> 2. splitting the primary signal to provide first and second microwave signals, wherein the first signal is transmitted through said material and the second signal provides an internal reference signal,
> 3. transmitting the first signal through at least a portion of the material,
> 4. receiving a third signal at a receiver, wherein the third signal includes the first signal after it has passed through the material possibly in combination with multi-path interference signals from the surrounding area that may or may not have passed through the material,
> 5. mixing the third signal together with the second signal, generating a mixed signal,
> 6. filtering the mixed signal to remove substantially all of the multi-path interference signals, generating a filtered-mixed signal, and
> 7. measuring the frequency of the filtered-mixed signal <u>to determine the propagation delay of the first signal after it has passed through the material,</u> and
> 8. <u>calculating the moisture content of the material from the propagation delay</u>, wherein the frequency of the primary signal varies sufficiently rapidly that the frequency of the third signal and the second signal will be different when they arrive at the mixer.

Thus, the process of the invention, as claimed, derives a measurement of the propagation delay (*i.e.*, time delay), which is a measurement of the actual time the signal is delayed as it

passes through the test material. The propagation or time delay is then used to determine the moisture content of the material. The process of the invention is free from and does not require measurement of the attenuation of the microwave signal. This is not disclosed or suggested by the prior art relied upon.

At the outset, Applicant notes that propagation delay and attenuation are two distinct and fundamentally different measurements which cannot be used interchangeably. Specifically, the "attenuation" measurement describes how much the signal strength is diminished from the transmitted level after propagation through the material. As disclosed by Mounce at col. 4, lines 5-13, this attenuation is a measure of the absorption of the energy of the signal by the test material. Thus, the attenuation of energy is a measurement of comparison of the transmitted signal strength versus the received signal strength. In contrast, the propagation delay (*i.e.*, time delay) such as disclosed by Larsen, is a measurement of the time it takes for the signal to propagate through the material (how much it is slowed down). Indeed, even Larsen distinguishes between these two measurements such as at col. 1, lines 29-33, and col. 6, lines 65 and 68. As noted above, the instant invention utilizes a measurement of the actual time delay of this signal (*i.e.*,

propagation delay) to determine moisture content. The signal strength variation (*i.e.*, attenuation) is of no concern in the instant process.

Returning now to the prior art of record, contrary to the assertions by the Examiner, Applicant respectfully submits that Larsen does not disclose measurement of moisture content at all, and Mounce does not calculate moisture content from the propagation delay of a signal. As described *supra*, Larsen discloses the determination of the "interrogation" of biological samples by measurement of both the time delay and signal attenuation (*i.e.*, absorption) "to characterize the type, functional state, and thickness of the tissue through which the wave length travels" (col. 1, lines 29-33)." No determination of moisture content is disclosed, nor is there any suggestion how it could be determined from the measurement of time delay.

The disclosure of Mounce does not alleviate the shortcomings in the Larsen disclosure. Again, Larsen discloses determining moisture content from measurement of the attenuation or absorption of the signal. There is no disclosure or suggestion of measuring the time delay (*i.e.*, propagation delay). Simply put, Larsen and Mounce teach measuring two different and distinct properties, time delay and attenuation. Because these properties

are different and are not interchangeable, the references could not be combined as suggested by the Examiner. A practitioner of ordinary skill in the art, with the references of record before them, would have no motivation to use Larsen's process for measuring time delay, with or as a substitute for Mounce's measurement of attenuation, because these are two fundamentally different properties. Even if the references were combined, there is no disclosure or suggestion that Larsen's time delay measurement could be utilized to calculate moisture content, much less how that could be done. Applicant is the first to discover that the time or propagation delay can be used to measure the moisture content of a material.

Finally, Applicant further notes that if anything, Larsen would teach away from the claimed method of measuring moisture content. Specifically, Larsen discloses that the process is preferably conducted by immersing the biological sample or target in water (col. 4, lines 31-33). Clearly, this would not be suitable for measuring moisture content (as the water would quickly saturate the cotton or other sample), and further illustrates that Larsen did not contemplate measuring moisture content. Moreover, the above-mentioned skilled practitioner would have no motivation to use the process of Larsen to measure

moisture content, when that same patent discloses that the sample is preferably immersed in water.

Rejection Under 35 U.S.C. 103

Claims 6 and 25 have been rejected under 35 U.S.C. 103 as being unpatentable over Larsen *et al.* in view of Mounce (U.S. 3,851,244) as applied to claim 1, and further in view of Nelson. The Examiner has taken the position that it would have been obvious to use the discrete time varying signal of Nelson in the process of Larsen and Mounce to enhance the accuracy of the measurement. Applicant respectfully disagrees.

Larsen, Mounce, and the instant invention were all described *supra*.

Nelson discloses a process for calculating the moisture content of grains by "determining the attenuation of an RF measurement signal...without direct measurement of the attenuation of the signal" (col. 2, lines 59-62). "Once the attenuation has been determined, the moisture content and mass grain flow may be determined" (abstract, lines 16-17). See also col. 5, lines 38-40. The patent does not disclose or suggest measuring time delay (or propagation delay), much less measuring time delay to determine moisture content.

Nelson does nothing to alleviate the deficiencies in the teachings of the references for the same reasons set forth in the response to the rejection of claim 1. Again, Nelson teaches determining the attenuation of a signal to calculate moisture content. The patent does not disclose measuring the time delay of the signal. Thus, the teachings of Nelson are substantially cumulative to Mounce, and the practitioner skilled in the art would have no motivation to use Larsen's process for measuring time delay, with or as a substitute for either Mounce's or Nelson's measurement of attenuation because these are two fundamentally different properties.

Rejection Under 35 U.S.C. 103

Claims 5, 21, and 23 have been rejected under 35 U.S.C. 103 as being unpatentable over Larsen *et al.* in view of Mounce (U.S. 3,851,244) as applied to claim 1, and further in view of Moshe *et al.* (U.S. 6,107,809). The Examiner has taken the position that it would have been obvious to use the step of determining path length of Moshe in the process of Larsen and Mounce to enhance the calculation of moisture content. Applicant respectfully disagrees.

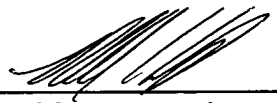
Larsen, Mounce, and the instant invention were all described *supra*.

Moshe *et al.* (hereinafter referred to as Moshe) discloses a process for calculating the moisture content of tobacco by measurement of the attenuation of a microwave signal passed through the material (col. 2, lines 36-52).

Because Moshe determines moisture content from the measurement of signal attenuation, this reference suffers from the same deficiencies as Mounce and Nelson. The practitioner skilled in the art would have no motivation to use Larsen's process for measuring time delay, with or as a substitute for either Mounce's or Moshe's measurement of attenuation because these are two fundamentally different properties.

In view of the foregoing, Applicant respectfully submits that claims 1-25 distinguish over the prior art of record. Allowance thereof is respectfully requested.

Respectfully submitted,



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